



SOUTHWEST GAS CORPORATION

® ENGINEERING STAFF

MATERIAL SPECIFICATION

Section No:	MS C-2
Page No.:	1 of 17
Issue Date:	03/01/16
Superseded Date:	01/29/15

Prepared By: Engineering Staff 

Approved By: Jerome T. Schmitz 

PIPE COATING

Extruded Polypropylene and Polyethylene Sheath

1. SCOPE

This specification covers pipe preparation, coating materials and application of extruded polypropylene and polyethylene sheath pipe coating on 3/4-inch to 20-inch steel pipe used to electrically isolate buried steel pipe from the surrounding soil.

The polypropylene sheath can be either orange or black in color and the polyethylene sheath can be either yellow or black in color.

2. APPLICABLE DOCUMENTS

- 2.1 American Petroleum Institute (API) 5-L, "Specification for Line Pipe."
- 2.2 ASTM International (ASTM) D-5, "Test Method for Penetration of Bituminous Materials."
- 2.3 ASTM International (ASTM) D-71, "Test Method for Relative Density of Solid Pitch and Asphalt (Displacement Method)."
- 2.4 ASTM International (ASTM) D-149, "Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies."
- 2.5 ASTM International (ASTM) D-256, "Test Method for Determining the Rendulum Impact Resistance of Notched Specimens of Plastic."
- 2.6 ASTM International (ASTM) D-257, "Test Method for D-C Resistance or Conductance of Insulating Materials."
- 2.7 ASTM International (ASTM) D-562, "Test Method for Consistency of Paints Using the Stormer Viscometer."
- 2.8 ASTM International (ASTM) D-570, "Test Method for Water Absorption of Plastics."
- 2.9 ASTM International (ASTM) D-618, "Practice for Conditioning Plastics and Electrical Insulating Materials for Testing."
- 2.10 ASTM International (ASTM) D-638, "Test Method for Tensile Properties of Plastics."



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2. APPLICABLE DOCUMENTS (Cont'd)

- 2.11 ASTM International (ASTM) D-647, "Practice for Design of Molds for Test Specimens of Plastic Molding Materials."
- 2.12 ASTM International (ASTM) D-696, "Test Method for Coefficient of Linear Thermal Expansion of Plastics."
- 2.13 ASTM International (ASTM) D-792, "Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement."
- 2.14 ASTM International (ASTM) D-1238, "Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer."
- 2.15 American Society for Testing and Materials (ASTM) D-1505, "Test Method for Density of Plastics by the Density Gradient Technique."
- 2.16 ASTM International (ASTM) D-1525, "Test Method for Vicat Softening Temperature of Plastics."
- 2.17 ASTM International (ASTM) D-1693, "Test Method for Environmental Stress — Cracking of Ethylene Plastics."
- 2.18 ASTM International (ASTM) D-2240, "Test Method for Rubber Property — Durometer Hardness."
- 2.19 ASTM International (ASTM) E-28, "Test Method for Softening Point by Ring and Ball Apparatus."
- 2.20 ASTM International (ASTM) G-23, "Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials."
- 2.21 Federal Specification (Fed. Spec.) L-C-530C, "Coating, Pipe, Thermoplastic Resin."
- 2.22 Military Standard (MIL STD) 105-D.
- 2.23 National Association of Pipe Coating Applicators (NAPCA).



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2. APPLICABLE DOCUMENTS (Cont'd)

- 2.24 Steel Structures Painting Council (SSPC) Surface Preparation (SP) Specification No. 6 (SSPC-SP-6), "Commercial Blast Cleaning."
- 2.25 United States Department of Transportation (DOT) Code of Federal Regulation (CFR), Title 49, Part 192, "Transportation of Natural and Other Gas by Pipeline; Minimum Safety Standards."

NOTE: Unless otherwise specified, the editions of the above documents incorporated by DOT 49 CFR 192 are applicable. Documents not incorporated by DOT 49 CFR will be the most recent edition.

3. TERMINOLOGY

3.1 General

- 3.1.1 "Southwest Gas," "Southwest" or "SWG" wherever used in this specification and other related documents will refer exclusively to Southwest Gas Corporation.
- 3.1.2 The term "approve," "as approved," "satisfactory," "as directed," "or equal," or other similar terms wherever used in this specification and other related documents shall mean "as determined by Southwest Gas," unless specifically stated otherwise.
- 3.1.3 "Product Information Package" or "PIP" wherever in this specification and other related documents will mean the required information that a manufacturer must submit to SWG to determine if the product is suitable for use by SWG, unless specifically stated otherwise.



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4. MATERIALS AND MANUFACTURING

4.1 General

4.1.1 Coating

- The pipe coating shall be designed, manufactured and applied specifically for the purpose of permanently protecting steel pipe against corrosion damage. The coating shall be suitable for continuous service in SWG's natural gas system. All features shall be acceptable to SWG.
- The steel pipe specified in the purchase order shall be prepared and coated as specified herein. The coating shall consist of a hot adhesive applied directly to the exterior surface of the pipe and a polypropylene or polyethylene coating applied to the adhesive.
- The pipe preparation and coating shall be in accordance with all applicable federal, state and local laws and regulations for use throughout SWG's serving areas.
- The coating applicator shall be a current registered member of NAPCA.

4.2 Technical

4.2.1 Adhesive

- The adhesive shall consist of a blend of rubber, asphalt, fluxing oil and high molecular weight resin.
- The adhesive shall be permanently tacky and shall have sufficient adhesion to the metal surface and plastic sheath to resist underfilm migration of moisture between the sheath and the steel pipe substrate.
- The adhesive shall contain no volatile solvents, shall be water resistant and shall be resistant to fungus and bacterial growth.
- The adhesive shall have the properties specified in Table C-2.1.



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4. MATERIALS AND MANUFACTURING (Cont'd)

4.2.2 Plastic Resin

- The polypropylene resin shall be 100 percent virgin, linear high density polypropylene resin with orange pigment or carbon black pigment (whichever is ordered) uniformly dispersed in the resin.
- The polyethylene resin shall be 100 percent virgin, linear high density polyethylene resin with yellow pigment or carbon black pigment (whichever is ordered) uniformly dispersed in the resin.
- The properties of the polypropylene and polyethylene plastic sheath materials shall be in accordance with Tables C-2.2 and C-2.3, respectively.



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4. MATERIALS AND MANUFACTURING (Cont'd)

PROPERTIES OF ADHESIVE				
PROPERTY	MAX	MIN	ASTM	FED. SPEC. L-C-530C TEST PARAGRAPH
Softening Point (°F/°C)	176	140	E-28	4.5.1.1
Penetration in MM. at 77°F/25°C	12.0	8.0	D-5	4.5.1.2
Impact Resistance at 0°F	—	No Cracks in 75% of Test		4.5.1.3
Flow in 1 hr. at 73.4°F/23°C (Inches)	0.19	—		4.5.1.4
Flow in 1 hr. at 160°F/71.1°C (Inches)	2.00	—		4.5.1.5
Viscosity at 300°F/148°C (Inches) (Sec. for 100 Rev.)	80	55	D-562	4.5.1.5
Viscosity at 270°F/132°C (Sec. for 100 Rev.)	180	120		4.5.1.5
Sieve Analysis	—	100		
Adhesion-Cohesion (1 lb.)	—	60 Cohesive Failure		
Specific Gravity at 77°F/25°C	1.20	1.08	D-71	

TABLE C-2.1

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4. MATERIALS AND MANUFACTURING (Cont'd)

PROPERTIES OF POLYPROPYLENE RESIN				
PROPERTY	MAX	MIN	ASTM	FED. SPEC. L-C-530C TEST PARAGRAPH
Specific Gravity @ 23°C/73.4°F	0.920	0.895	D-792	4.5.2.1
Flow Rate (g. 10 min.)	0.75	—	D-1238	4.5.2.2
Artificial Weathering		No Cracks After 288 Hours	G-23	4.5.2.3
Water Absorption (Percent by Wt.)	0.01	—	D-570	4.5.2.4
Tensile Yield Strength (psig/kPa)	—	3,000	D-638	4.5.2.5
Tensile Elongation (At break) (Percent)	—	100	D-638	4.5.2.5
Impact (Izod type) Resistance (Ft-Lb./In. of notch)	—	2.0	D-256 D-618 D-647	4.5.2.6
Indentation Hardness (Durometer, Type D)	—	55 1,000	D-2240	4.5.2.7
Dielectric Strength (Volts/Mil)	—	16 10	D-149	4.5.2.8
Volume Resistivity (Ohm-Cm)	—	245	D-257	4.5.2.9
Vicat Softening P.t. (°F/°C)	—	—	D-1525	4.5.2.10
Coef. of Linear Thermal Expansion (In./In. Per °F)	0.0001	0.85	D-696	4.5.2.11
Density (Pogmented) (g/cm3)	0.95	.90	D-792	
Orange Pigment content (Percent by Wt.)	1.0	2.4		
Carbon Black Content (Percent by Wt.)	2.6	—		
Environment Stress Crack Resistance (F50 hours)	—		D-1693	

TABLE C-2.2



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4. MATERIALS AND MANUFACTURING (Cont'd)

PROPERTIES OF POLYETHYLENE RESIN				
PROPERTY	MAX	MIN	ASTM	FED. SPEC. L-C-530C TEST PARAGRAPH
Specific Gravity @ 73.4°F/23°C	0.965	0.941	D-792	4.5.2.1
Flow Rate (g.10 Min.)	0.75	—	D-1238	4.5.2.2
Artificial Weathering		No Cracks After 288 Hours	G-23	4.5.2.3
Water Absorption (Percent by Wt.)	0.01	—	D-570	4.5.2.4
Tensile Yield Strength (PSI/kPa)	—	3,000	D-638	4.5.2.5
Tensile Elongation (At break) (Percent)	—	2,200	D-638	4.5.2.5
Impact (Izod type) Resistance (Ft.-Lb./In. of notch)	—	2.0	D-256 D-618	4.5.2.6
Indentation Hardness (Durometer, Type D)	—	55	D-2240	4.5.2.7
Dielectric Strength (Volts/Mil)	—	1,000	D-149	4.5.2.8
Volume Resistivity (Ohm-cm)	—	16 10	D-257	4.5.2.9
Vicat Softening P.t. (°F/°C)	—	245	D-1525	4.5.2.10
Coef. of Linear Thermal Expansion (In./In. per °F)	0.0001	—	D-696	4.5.2.11
Density (Pigmented) (g/cm ³)	0.965	0.941	D-1505	
Yellow Pigment Content (Percent by Wt.)	2.1	1.9		
Carbon Black Content (Percent by Wt.)	2.6	2.4		
Environment Stress Crack Resistance	100	—	Condition B 100% Igepal	

TABLE C-2.3



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4. MATERIALS AND MANUFACTURING (Cont'd)

4.3 Application:

4.3.1 Surface Preparation

The exterior surface or the steel pipe to be coated shall be cleaned of grease, oil and dirt prior to abrasive cleaning. The pipe shall then be abrasive steel shot- or grit-blasted cleaned to SSPC-SP-6. The external pipe surface shall be dry prior to the adhesive application.

4.3.2 Adhesive Application

The adhesive shall be applied to the pipe at 300°F (149°C) plus or minus 10°F (-12°C) to a uniform thickness between 9 and 11 mils.

4.3.3 Plastic Resin Application

The plastic shall be applied over the adhesive by an extrusion process so as to provide a smooth outer sheath uniform in thickness and free from pinholes, bubbles, blisters, wrinkles, cracks, underfilm voids or contamination from other plastics and color pigments or mechanical damage.

4.3.4 Coating Cutback

Each coated joint of pipe shall have a nominal cutback (uncoated length) of 3 inches (±1 inch) at each end to facilitate welding pipe without damaging the coating. The cutback shall be clean of any adhesive. Allowing for shrinkage, the maximum length from the end of the polypropylene or polyethylene to the end of the pipe is 6 1/2 inches.

4.3.5 Plastic Sheath Thickness

The thickness of the plastic sheath applied to various pipe sizes shall conform to the schedule given to Table C-2.4.



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4. MATERIALS AND MANUFACTURING (Cont'd)

POLYPROPYLENE AND POLYETHYLENE SHEATH THICKNESS				
PIPE SIZE (Inches)	STANDARD SHEATH THICKNESS		60 MIL SHEATH THICKNESS	
	Nominal	Minimum	Nominal	Minimum
1/2 to 1 1/2 Nom.	25	23	60	54
2 3/8 to 2 7/8 OD	30	27	60	54
3 1/2 to 4 1/2 OD	35	32	60	54
5 9/16 to 20 OD	40	36	60	54

* Unless specified otherwise, the standard sheath thickness will be supplied.

TABLE C-2.4

4.4 Coating Repairs

Unless otherwise specified by SWG, coating repairs shall be subject to all the requirements of this section using any combination of the types of repairs listed but cannot exceed the total number of repairs given in Table C-2.5.

Size of Project (Total Number of Pipe Joints)	Number of Repairs Per Pipe Joint	Number of Repaired Pipe Joints Allowed
25 or Less	2	1
26 to 50	2	2
51 to 150	2	3
Greater than 150 of Total	2	2%

TABLE C-2.5



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4. MATERIALS AND MANUFACTURING (Cont'd)

4.5 Double Jacketing Coating Repair

- 4.5.1 All sizes of coated pipe may be double coated subject to the provisions of this section.
- 4.5.2 The pipe lengths containing the double coated repair shall be so identified.
- 4.5.3 Double jacketing shall not be permitted if the initial adhesive does not meet the requirements of Section 4.
- 4.5.4 Where double jacketing is utilized, the second coating of polypropylene or polyethylene and adhesive shall conform in all respects to the requirements of Sections 4 and 5.
- 4.5.5 The double jacketed pipe shall be electrically tested for defects using 15,000 volts minimum.
- 4.5.6 Before application of the second coating, the initial plastic sheath shall be trimmed and cut smooth as required so that no protrusions will be formed on the exposed surface of the second sheath.
- 4.5.7 Before application of the second coating, the initial coating and adhesive shall be removed for a distance of 4 inches beyond SWG's specified coating cut back found in Paragraph 4.3.4.
- 4.5.8 The undercoating and polypropylene or polyethylene sheath of the second coating shall be applied for the full length of pipe less the amount of cutback specified in Paragraph 4.3.4.
- 4.5.9 On a specific project, the number of pipe joints with double jacketing shall not exceed 2 percent of the total number of pipe lengths ordered for that project.

4.5 Shrink Sleeve Coating Repair

- 4.5.1 The plastic shrink sleeve may be repaired by use of shrink sleeves of a type approved by SWG and subject to the requirements of this section.
- 4.5.2 A plastic shrink sleeve repair shall be allowed only where the damage area of the sheath does not exceed a width of 6 inches and the shrink sleeve shall extend beyond the damage area by a minimum of 2 inches all around. The shrink sleeve must extend around the full circumference of the pipe.



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- 4.5.3 The damaged area of the plastic sheath shall be prepared for repair by removing the entire plastic sheath that is raised and does not adhere to the adhesive.
- 4.5.4 All surfaces that will be under the shrink sleeve shall be cleaned and all foreign matter removed.
- 4.5.6 The shrink sleeve shall be applied as recommended by the shrink sleeve manufacturer.

4.6 Tape Coating Repair

- 4.6.1 Unless otherwise specified by SWG, the plastic sheath may be repaired using polyken tape and primer and subject to the requirements of this section.
- 4.6.2 A taped plastic sheath repair shall be allowed only where the damaged area of the sheath does not exceed a width of 3 inches and the plastic sheath repair shall extend beyond the damaged area by a minimum of 2 inches.
- 4.6.3 The damaged area of the plastic sheath shall be prepared for repair by removing all plastic sheath that is raised or does not adhere to the adhesive.
- 4.6.4 All surfaces that will be under the tape shall be cleaned, all foreign matter removed and primed with polyken primer.
- 4.6.5 Tape repairs must extend around the full circumference of the pipe and may be applied as a spiral half-lap wrapping or a cigarette wrap.

5. PERFORMANCE REQUIREMENTS

- 5.1 The pigmented coating shall be capable of withstanding outdoor exposure for at least one year for the orange-coated polypropylene and for at least five years for the black-coated polypropylene with no significant loss of properties or any deleterious effects to the coating.



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5. PERFORMANCE REQUIREMENTS (Cont'd)

- 5.2 The pigmented coating shall be capable of withstanding outdoor exposure for at least one year for the yellow-coated polyethylene and for at least five years for the black-coated polyethylene with no significant loss of properties or any deleterious effects to the coating.
- 5.3 The coating system shall show no defects when subjected to the electrical flaw detection test as specified in Fed. Spec. L-C-530C.
- 5.4 The coating system shall be electrically tested for defects using a holiday detector set at 10,000 volts minimum immediately after the plastic sheath is water cooled.
- 5.5 The coating system shall show no cracking, blistering, lifting of the coating or fungus growth when tested as specified in Fed. Spec. L-C-530C.

6. INSPECTION

- 6.1 Successful review of the Product Information Package (PIP), as well as any future reference by SWG to the Seller's part number or internal code number in any future contract or purchase, will mean only that no conflict with the specification was found and will not relieve the Seller from meeting all the requirements of this specification.
- 6.2 SWG retains the option to inspect the manufacture and testing of any and all materials, products or systems referenced in this specification that are sold to SWG.
- 6.3 SWG will make appropriate inspections and tests of any and all materials, products or systems supplied to this specification. SWG will have the right, at their option, to reject any material which fails to conform to this specification. Any such rejection may take place at the manufacturer facility; the supplier's warehouse or any subsequent delivery location, before or after SWG assumes possession. Notice of the rejection will be made promptly to the supplier by SWG. The defective product will be replaced or returned for credit at the manufacturer's expense.



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6. INSPECTION (Cont'd)

- 6.4 Any changes in the manufacturing of previously approved materials, products or systems described in this material specification for sale to SWG, must be approved by SWG's Engineering Staff. **Failure to obtain SWG's approval may be cause for rejection and disqualification as an approved supplier.**
- 6.5 SWG's Engineering Department shall be notified one week in advance of any coating of pipe to afford time to make arrangements for inspection.
- 6.6 Entire lots may be rejected if a representative sample does not meet the acceptance quality level.

7. CERTIFICATION

The manufacturer's or supplier's certification shall be furnished to Southwest. This certification shall state that samples representing each lot have been manufactured, tested and inspected in accordance with this specification and that all requirements have been met. When requested or specified in the purchase order or contract, a report of test results will be provided.

Upon the request of Southwest, the certification of an independent third party indicating conformance to the specification may be considered at Southwest's expense.

8. SAFETY DATA SHEETS

In accordance with law, the Seller will supply Safety Data Sheets for all applicable items supplied under this specification to the following:

- 1) The Receiving Location
- 2) Engineering Staff
- 3) Southwest Gas Corporation
Corporate Safety
Mail Station LVA-120
P.O. Box 98510
Las Vegas, NV 89193-8510



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9. PRODUCT MARKING

The identification marking of the bare pipe (e.g., information per API 5-L) shall be legibly reproduced on the O.D. of the coating along with the following:

- Coater's name
- Extruded coating (polypropylene or polyethylene)
- Date coating applied
- Pipe of different wall thickness for the same project shall have a specific colored stripe painted at both ends of the pipe over the coating to differentiate that wall thickness from any other wall thickness.

10. PACKAGING & PACKAGE MARKING

- 10.1 Coated pipe shall, at all times, be handled with equipment such as nylon slings 6-inch or greater width, approved end hooks or padded forks designed to prevent damage to the coating. Cables, chains metal bars, narrow skids or unpadded forks shall not be permitted to come in contact with the coating.
- 10.2 Under no circumstances shall the pipe be rolled directly off the truck or gondola car onto the ground or be allowed to roll down the skids without rope snubs to prevent the pipe from hitting the ground and causing damage to the coating.
- 10.3 Under no circumstances shall the pipe be rolled off a pile without the use of padded skids and a snubbing rope at each end.
- 10.4 Under no circumstances shall coated pipe be pyramided. Each layer of pipe shall be supported separately by the use of padded skids. The ends of the padded skids shall be blocked to prevent the coated pipe from rolling off the end of the skid.



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10. PACKAGING & PACKAGE MARKING (Cont'd)

10.5 Pipe sizes and maximum tier heights shall be as follows:

- Pipe sizes up to and including 3-inch shall be stacked using pipe bundles to a maximum of 6 high per bundle. This method of stacking provides for each layer of pipe to be supported separately. The boards and blocks used shall be a permanent part of the bundle.
- Pipe sizes 4-inch through 6-inch can be stacked to a maximum of 8 tiers.
- Pipe sizes 8-inch through 10-inch can be stacked to a maximum of 6 tiers high.
- Pipe sizes 12-inch through 16-inch can be stacked to a maximum of 4 tiers high.
- Pipe size 20-inch can be stacked to a maximum of 3 tiers high.

NOTE: Short lengths of pipe shall always be stacked on the top tier to prevent flattening of the ends.

10.6 Externally coated pipe shall be stacked upon supports that have broad padded bearing surfaces or covered sand rows that are free of rocks, sticks or other objects with sharp edges which might damage the coating.

10.7 When coated pipe is placed in storage, the bottom tier shall be elevated far enough above the ground to prevent silt laden rainwater from washing into the open ends of the pipe.